

REMARKS

This is a response under 37 CFR §1.116. The purpose of this response is to address the arguments made by the Examiner in the last office action. Since this response is being filed within two months of the mailing date of the final rejection, a notice of allowance or an advisory action is respectfully requested. Claims 65-80 are in this application. Claims 1-64 have been cancelled.

The Examiner rejected claims 65-80 under 35 U.S.C. §102(e) as being anticipated by Han et al. (U.S. Patent No. 6,281,135). For the reasons set forth below, applicant respectfully traverse this rejection.

Claim 65 recites:

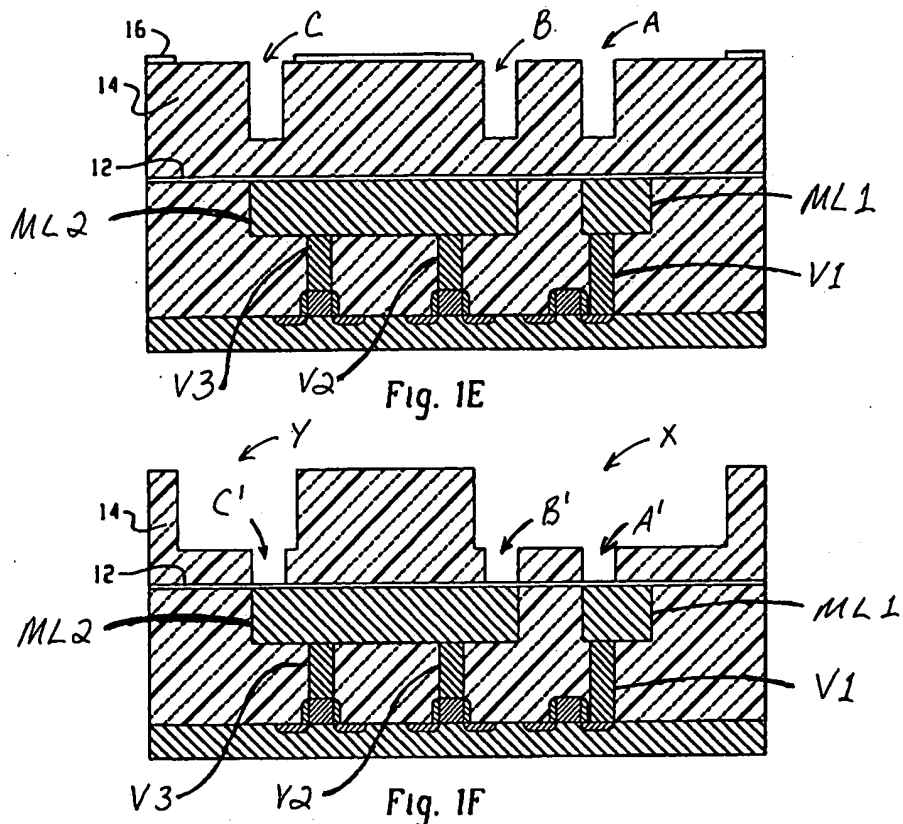
"A method of forming a conductor on a semiconductor structure, the semiconductor structure having a layer of insulation material and a via that contacts the layer of insulation material, the layer of insulation material having a top surface, the method comprising:

"etching the top surface of the layer of insulation material to form a plurality of spaced-apart first openings in the layer of insulation material, each first opening having a bottom surface that lies below the top surface of the layer of insulation material; and

"simultaneously etching the top surface of the layer of insulation material and the bottom surface of each first opening to form a second opening in the layer of insulation material, and lower the bottom surface of each first opening to form a plurality of spaced-apart lowered first openings that each have a bottom surface, the bottom surfaces of two or more of the plurality of spaced-apart lowered first openings exposing the via, the second opening having a top that lies in a common plane with the top surface of the layer of insulation material, and a bottom that lies below the top surface of the layer of insulation material, each of the plurality of spaced-apart lowered first openings extending away from the bottom of the second opening."

Claim 69 recites similar limitations, reciting a contact rather than a via.

In rejecting claims 65 and 69, the Examiner pointed to dielectric layer 14 shown in FIGS. 1C-1F of Han as constituting the layer of insulation material. In addition, the Examiner, citing FIGS. 1C-1F and column 6, lines 9-36 of Han, asserted that the Han reference teaches the elements of claims 65 and 69. To address the Examiner's assertions, applicant has included below annotated versions of FIGS. 1E and 1F of Han.



As shown in the annotated version of FIG. 1E, the Han reference teaches a structure that includes a first contact V1, a second contact V2, and a third contact V3. In addition, the structure also includes a first metal line ML1 that lies over and touches

contact V1, and a second metal line ML2 that lies over and touches the contacts V2 and V3.

As further shown in the annotated version of FIG. 1E, Han teaches the formation of first openings A, B, and C in dielectric layer 14 (read by the Examiner to be the layer of insulation material required by claims 65 and 69). Applicant assumes that the Examiner has read the formation of first openings A and B in dielectric layer 14 to be the formation of the plurality of spaced-apart first openings in the layer of insulation material as required by claims 65 and 69.

As shown in the annotated version of FIG. 1F, following an etch, Han teaches the formation of second openings X and Y, and lowered spaced-apart first openings A', B', and C' in dielectric layer 14. Applicant notes that second opening Y can not be read to be the second opening required by claims 65 and 69. This is because Han fails to teach that each of a plurality of spaced-apart lowered first openings extend away from the bottom of the second opening (second opening Y) as required by claims 65 and 69.

In the annotated version of FIG. 1F of Han, only one lowered first opening, i.e., lowered first opening C', is shown extending away from second opening Y. Thus, since Han fails to teach that second opening Y has two or more lowered first openings extending away from it, second opening Y can not be read to be the second opening required by claims 65 and 69.

Since second opening Y can not be read to be the second opening required by claims 65 and 69, Applicant assumes that the Examiner has read the formation of second opening X in dielectric layer 14 to be the formation of the second opening in the layer of insulation material as required by claims 65 and 69. In addition, applicant also assumes that the Examiner has read the lowering of the bottom surface of each

first opening A and B in dielectric layer 14 to form the lowered spaced-apart first openings A' and B' to be the lowering of the bottom surface of each first opening to form the spaced-apart lowered first openings as required by claims 65 and 69.

However, from what can be determined, there is no structure which can be read to be "the via" required by claims 65 and 69. The Examiner can not read metal line ML1 shown in the annotated version of FIG. 1F of Han to be the via required by claims 65 and 69 because metal line ML1 is not a via. Metal lines (traces) and vias, which connect metal lines in different layers together, are both well-known structures in the semiconductor art.

In addition, the Examiner can not read metal line ML1 to be the via required by claims 65 and 69 because Han fails to teach that the bottom surfaces of two or more of the plurality of spaced-apart lowered first openings expose the via as required by claims 65 and 69. As shown in FIG. 1F of the Han reference, rather than teaching that the bottom surfaces of two or more lowered first openings expose metal line ML1, Han instead teaches that the bottom surface of only one lowered first opening, i.e., lowered first opening A', exposes metal line ML1.

Thus, metal line ML1 can not be read to be the via required by claims 65 and 69 because a metal line is not a via, and Han fails to teach that two or more lowered first openings expose the via as required by claims 65 and 69.

Further, the Examiner can not read metal line ML2 shown in the annotated version of FIG. 1F of Han to be the via required by claims 65 and 69 because metal line ML2 is not a via. In addition, the Examiner can not read metal line ML2 to be the via required by claims 65 and 69 because Han fails to teach that two or more lowered first openings expose the via as required by claims 65 and 69.

As shown in the annotated version of FIG. 1F, Han teaches that lowered first openings B' and C' both expose metal line ML2. However, as discussed above, claims 65 and 69 require that each of the plurality of spaced-apart lowered first openings extend away from the bottom of the second opening. Thus, if second opening X shown in the annotated version of FIG. 1F is read to be the second opening required by claims 65 and 69, then lowered first opening C' can not be read to be a lowered first opening of claims 65 and 69 because lowered first opening C' does not extend away from second opening X.

Since lowered first opening C' can not be read to be a lowered first opening, only lowered first opening B' can be read to be a lowered first opening as required by the claims. Claims 65 and 69, however, require that two or more lowered first openings expose the via. Thus, since the Han reference teaches that only one lowered first opening, i.e., lowered first opening B', exposes metal line ML2, and claims 65 and 69 require that two or more of the lowered first openings expose the via, metal line ML2 can not be read to be the via required by claims 65 and 69.

As a result, metal line ML2 can not be read to be the via required by claims 65 and 69 because a metal line is not a via, and Han fails to teach that two or more lowered first openings expose the via as required by claims 65 and 69.

Therefore, since metal lines ML1 and ML2 can not be read to be the via required by claims 65 and 69, there appears to be no structure which can be read to be the via. Since there is no structure which can be read to be the via, claims 65 and 69 are not anticipated by the Han reference. In addition, since claims 66-68 depend either directly or indirectly from claim 65, claims 66-68 are not anticipated by Han for the same reasons as claim 65. Further, since claims 70-72 depend either directly or

indirectly from claim 69, claims 70-72 are not anticipated by Han for the same reasons as claim 69.

With further respect to claims 66, 67, 70, and 71, these claims require the bottom surface of a/each lowered first opening expose an area of the via and an area of the insulation material. In rejecting the claims, the Examiner asserted that the Han reference teaches these limitations. However, as shown in the annotated version of FIG. 1F, the bottom surface of each lowered first opening A', B', and C' exposes only an area of a metal trace. The side wall surfaces of the lowered first openings A', B', and C' expose an area of insulation material 14, but the bottom surface of each lowered first opening A', B', and C' exposes only an area of a metal trace. As a result, claims 66, 67, 70, and 71 are not anticipated by Han for these additional reasons.

Claim 73 recites:

"A method of forming a conductive line on a semiconductor structure, the semiconductor structure having a layer of insulation material, the layer of insulation material having a top surface, the method comprising:

"etching the top surface of the layer of insulation material to form a plurality of spaced-apart first trenches in the layer of insulation material, each first trench having a bottom surface that lies below the top surface of the layer of insulation material, a first width, and a first length that is substantially greater than the first width; and

"simultaneously etching the top surface of the layer of insulation material and the bottom surface of each first trench to form a second trench in the layer of insulation material, and lower the bottom surface of each first trench to form a plurality of spaced-apart lowered first trenches, the second trench having a top that lies in a common plane with the top surface of the layer of insulation material, a bottom that lies below the top surface of the layer of insulation material, a second width, and a second length that is substantially greater than the second width, each of the plurality of spaced-apart lowered first trenches extending away from the bottom of the second trench and having a third width and a third length that is substantially greater than the third width."

In rejecting claim 73, the Examiner, again citing FIGS. 1C-1F and column 6, lines 9-36 of the Han reference, asserted that the Han reference teaches the elements of claim 73.

As noted above, the annotated version of FIG. 1E of Han teaches the formation of first openings A, B, and C in dielectric layer 14. Applicant assumes that the Examiner has read dielectric layer 14 to be the layer of insulation material required by claim 73. Applicant also assumes that the Examiner has read the formation of first openings A and B in dielectric layer 14 to be the formation of the plurality of spaced-apart first trenches as required by claim 73.

The formation of openings A and B in dielectric layer 14, however, can not be read to be the formation of the plurality of spaced-apart first trenches as required by claim 73 because Han teaches that openings A and B are formed as via openings. The Han reference teaches that a photoresist 16 is formed "as a masking material to form the vias as shown in FIG. 1C." (See column 6, lines 18-19 of Han.) Openings are then partially etched into dielectric layer 14 to form the openings A, B, and C, which are shown in the annotated version of FIG. 1E. Applicant, however, has been unable to find any discussion in Han that teaches or suggests that the via openings A, B, and C are formed as trenches that have a length that is substantially greater than a width as required by claim 73.

Thus, since there is nothing in Han that teaches or suggests that openings A, B, and C shown in the annotated version of FIG. 1E are formed as trenches, openings A, B, and C can not be read to be the first trenches. Since openings A, B, and C can not be read to be the first trenches, claim 73 is not anticipated by the Han reference.

Further, since claims 74-80 depend either directly or indirectly from claim 73, claims 74-80 are not anticipated by Han for the same reasons as claim 73.

With further respect to claims 78 and 79, these claims require the bottom surface of a/each lowered first trench expose an area of the conductive region and an area of the insulation material. In rejecting the claims, the Examiner asserted that the Han reference teaches these limitations. However, as shown in the annotated version of FIG. 1F, the bottom surface of each lowered first opening A', B', and C' exposes only an area of a metal trace. The side wall surfaces of the lowered first openings A', B', and C' expose an area of insulation material 14, but the bottom surface of each lowered first opening A', B', and C' exposes only an area of a metal trace. As a result, claims 78 and 79 are not anticipated by Han for these further reasons.

Thus, for the foregoing reasons, it is submitted that all of the claims are in a condition for allowance. Therefore, the Examiner's early re-examination and reconsideration are requested.

Respectfully submitted,

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